MONTANA

FOREST PEST CONDITIONS AND PROGRAM HIGHLIGHTS 1990

Report 91-2

April 1991

USDA Forest Service
Northern Region

MT Dept of State Lands
Forestry Division

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1990

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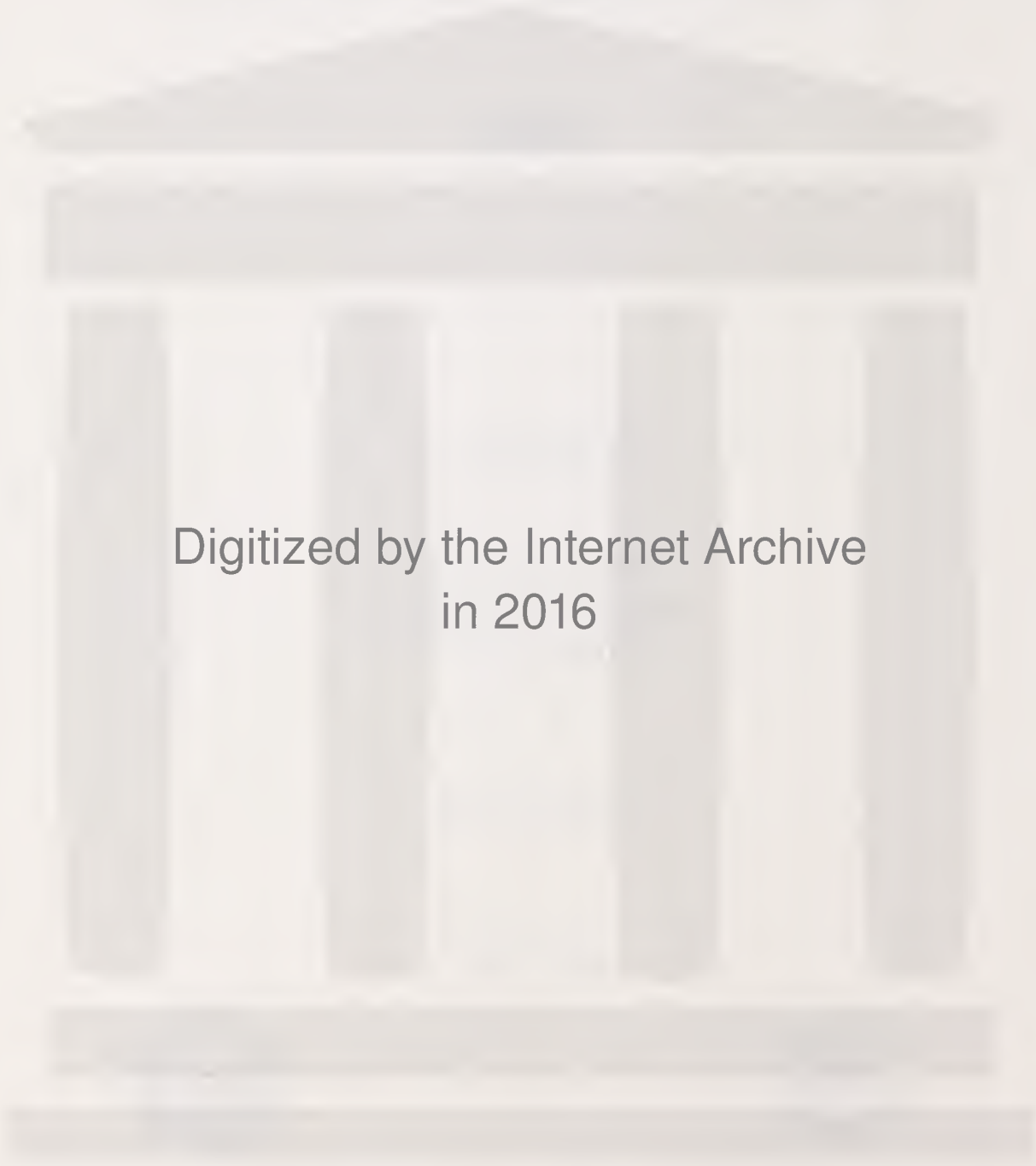

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INTRODUCTION

This report summarizes pest conditions in Montana in 1990 and was jointly prepared by the USDA Forest Service, Timber, Cooperative Forestry and Pest Management, and the Montana Department of State Lands. Information for the report was obtained from aerial and ground surveys, and on-site biological evaluations.

The major pests of forested lands throughout the State are discussed and acres of land affected are listed by ownership. Highlights of pest management programs and a list of recent publications are also included.

SUMMARY OF CONDITIONS

The major forest insects and diseases occurring on lands of all ownerships throughout Montana in 1990 were root diseases, dwarf mistletoes, mountain pine beetle, and western spruce budworm. The acres of forest lands affected by root diseases and dwarf mistletoes has remained fairly constant over the last 10 years (Figure 1). Although the effects of these diseases do not fluctuate greatly from year to year, the chronic effects on stand productivity are large. Root diseases, mainly Armillaria root disease and laminated root rot, were a problem on approximately 1.4 million acres, causing estimated volume losses of 40 MM cubic feet. Most of the damage from root diseases occurs in Douglas-fir and grand fir forests west of the Continental Divide. Dwarf mistletoes occurred on approximately 2.5 million acres in 1990; they infested western larch and Douglas-fir west of the Continental Divide, and lodgepole pine throughout the State for a total estimated volume loss of 33 MM cubic feet.

Lodgepole pine needle cast was especially severe and widespread throughout the State in 1990. Dutch elm disease continued to cause serious economic impact in Montana cities and was especially damaging in Great Falls, Billings, and Forsyth. Severe bear damage occurred in young western larch stands on the Kootenai NF.

Mountain pine beetle populations continued a downward trend in 1990 (Figure 1); however, the beetle continued to cause significant damage to pine forests across the State. Approximately 200,000 acres were infested statewide in 1990 with associated volume losses estimated at 12 MM cubic feet. The most serious impacts from mountain pine beetle occurred in lodgepole pine stands on the Kootenai NF. Defoliation by western spruce budworm occurred on a total of 1.5 million acres in 1990 and resulted in volume losses of 10 MM cubic feet. While this level of infestation was well below the peak of 1985, it did represent a slight increase from the 1989 level (Figure 1). The largest increases in defoliated acres occurred on the Lewis and Clark and Lolo National Forests.

Insects that caused localized areas of heavy damage included Douglas-fir beetle, western pine beetle, western balsam bark beetle, pine engraver beetle, and western false hemlock looper.

Intensive trapping to detect gypsy moth populations continued throughout the State in 1990. One moth was trapped in Great Falls, and one in nearby Yellowstone Park.

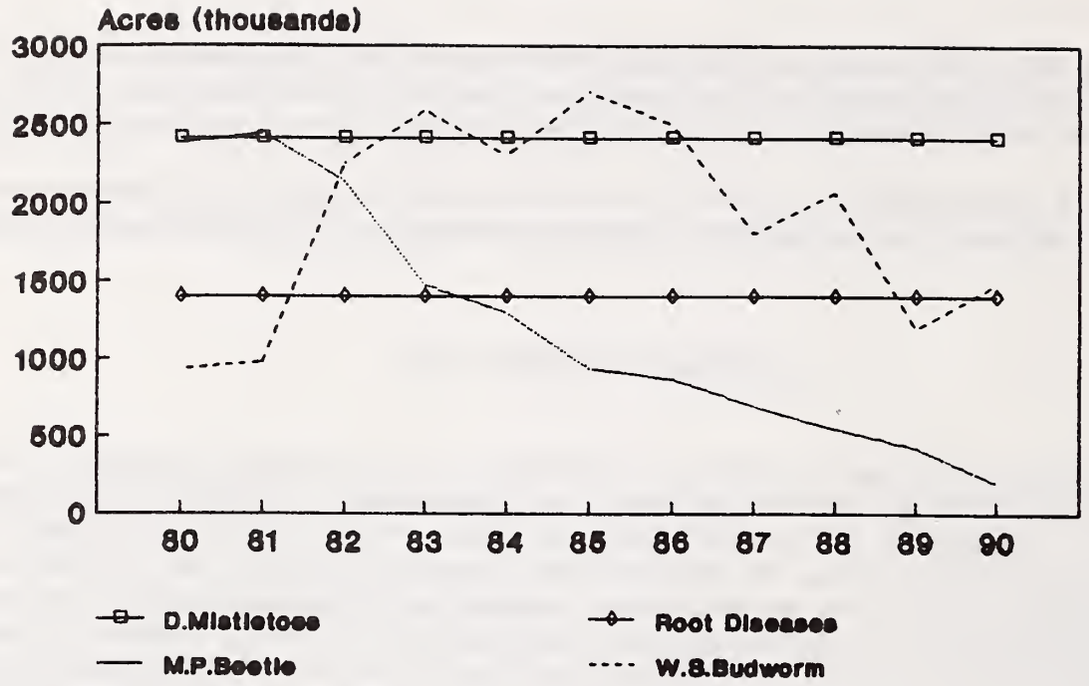


Figure 1.--Occurrence of major insects and diseases in Montana, 1980-1990.

DISEASES

Summary of New Disease Developments

Lodgepole Pine Needle cast

Lodgepole pine needle cast was severe and widespread throughout Montana in 1990. The high disease incidence seen in 1990 was the result of infections that occurred in late spring and summer of 1989. Lodgepole pine needles become infected in the early summer during periods of high humidity and start to turn reddish-brown in May or June of the following year. Needles continue to discolor and fall from the tree in July and August. Infections usually occur uniformly throughout the crown in small trees but are often most severe in the bottom half or third of the crown in larger trees. Needle loss may result in growth reduction in individual trees, but very little is known about the long-term effects of this disease on stand growth and timber production. Lodgepole needle cast seldom results in tree mortality. When there is mortality, it occurs in trees of low vigor, stressed trees, and may be associated with other pathogens or bark beetles. Whether or not there is a repeat of high disease levels in 1991 will depend on whether or not the weather conditions in 1990 were conducive for extensive infection to occur.

Lodgepole needle cast was severe at the Condon Tree Improvement Area. Managers rated trees to evaluate possible genetic resistance to this disease.

Animal Damage

Severe damage from squirrels and bears occurred in young western larch plantations on the Kootenai NF. The bears ripped the bark from the base of trees, and frequently returned to the same area several years in a row. The squirrels caused topkill of the upper 1-6 feet of the crown.

Dutch Elm Disease

Dutch elm disease (DED) continued to cause substantial economic impact in Montana cities in 1990. Cities most severely affected were Great Falls, Billings, and Forsyth. Dutch elm disease was discovered in Great Falls in 1987. Since that time it has infected and/or killed 5,269 trees, more than 40 percent of all American elms in the City (Figure 2). High losses are expected to continue for several years. In Billings, 111 infected American elms were removed in 1990. Billings has lost almost 5,000 trees since the disease was first discovered there in 1979. This loss represents 50 percent of the American elms in the City. Forsyth has lost approximately 75 percent of the American elms in the City.

Data on DED was provided by Jon G. Thompson (City Forester, Great Falls) and Gene Blackwell (City Parks Director, Billings).

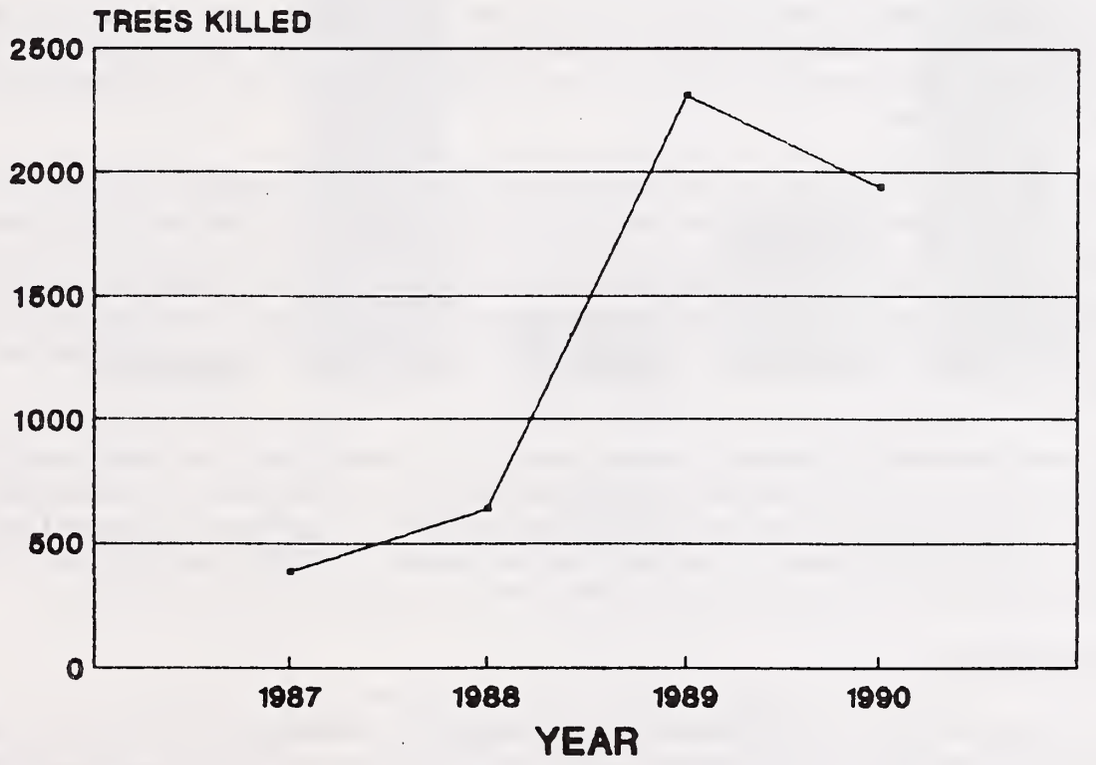


Figure 2.--American elms lost to Dutch elm disease in Great Falls, 1987-1990.

Nursery/Tree Improvement Diseases

Armillaria root disease became more damaging in several tree improvement plantations in Montana. In particular, the Yaak-Kilbrennan Plantation on the Kootenai National Forest was beginning to display tree mortality from this disease.

Early frost damage was common at the Bigfork Tree Improvement Plantation (Flathead National Forest), especially on young western larch seedlings. Rhabdocline needle cast was present at relatively low levels on Douglas-fir seedlings.

Drought injury to caragana seedlings was extensive at the Montana State Nursery, Missoula.

Aspen seedlings were damaged by *Venturia tremulae* at the Bitterroot Native Growers Nursery in Hamilton.

Grey mold damage occurred on container-grown sumac (*Rhus glabra*) seedlings at Bitterroot Native Growers Nursery in Hamilton.

Copper deficiency was found on container-grown Black Hills spruce seedlings grown at the Tree Factory Nursery in Bozeman.

Review of Pathology Projects

Annosus Root Disease

An annosus root disease study is in progress on the Elk City and Clearwater Ranger Districts of the Nez Perce National Forest. Two pairs of stands in the grand fir habitat series have been examined intensively, with a third pair scheduled for examination during the summer of 1991. Each pair consists of a 10- to 20-year-old clearcut and an adjacent uncut stand.

The population structure of *H. annosum* is being examined to determine the relative importance of spore infection vs. vegetative spread. Spore infections may be prevented by treating freshly-cut stumps and avoiding injury to residual trees during any stand manipulations. Vegetative spread can best be controlled by planting non-host species in areas where annosus root disease is present. Preliminary results indicate isolates from two of the clearcut stands are genetically distinct from nearly all other isolates from the same stands. This suggests spore infections may be playing an important role in initiating new infection centers in the clearcuts.

Presence of fungal intersterility groups on these sites is also being determined. Preliminary results indicate all collected isolates are of the "S" intersterility group. This is important in that *H.annosum* intersterility groups are generally host specific. In this area, the "S" group affects true firs, Engelmann spruce and Douglas-fir. Further infection might be discouraged by planting non-host species in areas where annosus root disease is present. Final results and conclusions from this study will be available in December, 1991.

Armillaria Root Disease

Like stirring up a hornets' nest, commercial thinning appears to have "stirred up" Armillaria root disease in a Douglas-fir stand that has been monitored for 9 years. Hellroaring stand, on the Flathead Indian Reservation in Montana was commercially thinned in 1979. The stand is on a high-quality Douglas-fir/ninebark habitat type. It averaged 55 years of age in 1979, and Douglas-fir made up 77 percent of the basal area of the stand with ponderosa pine and western larch well scattered in the stand. All trees on a 3/4-acre plot have been examined yearly since plot establishment in 1981. Armillaria root disease was present before the thinning. Use of thinning to improve vigor and reduce disease was evaluated.

At age 55 before thinning, the stand had about 3,960 cu ft/A. Commercial thinning was intended to remove about 30 percent of the volume by taking the least vigorous-appearing trees first and additional non-symptomatic trees to reach the desired stocking. Volume after thinning was 2,617 cu ft/A. The trees left after thinning had been growing well with full crowns. Two years after thinning, when the plots were established, about 120 cu ft/A of timber was again visibly infected (4.7 percent of the total). In the third and fourth years after the thinning, the mortality rate increased to 8.7 percent of the total volume. Twenty-one percent of the volume was in diseased or dead trees. In June of 1989, 10 years after thinning, 35 percent of the cu ft volume that had been left after thinning was either diseased or dead. This is 46 percent of the Douglas-fir by volume and 53 percent of the stems. Ponderosa pine and western larch comprised 590 cu ft/A in 1989-- this may be all that is left (with whatever growth these species put on) within the next 15 years. Increased growth on residual trees has offset only a small part of the mortality because there are fewer trees/A left (76 trees/A in June 1989).

Note the erratic changes in the annual mortality rates (Figure 3). This is the first time we have incorporated annual inspections into permanent plot projects, so it is the first time we have been able to discern this type of fluctuation in mortality rates.

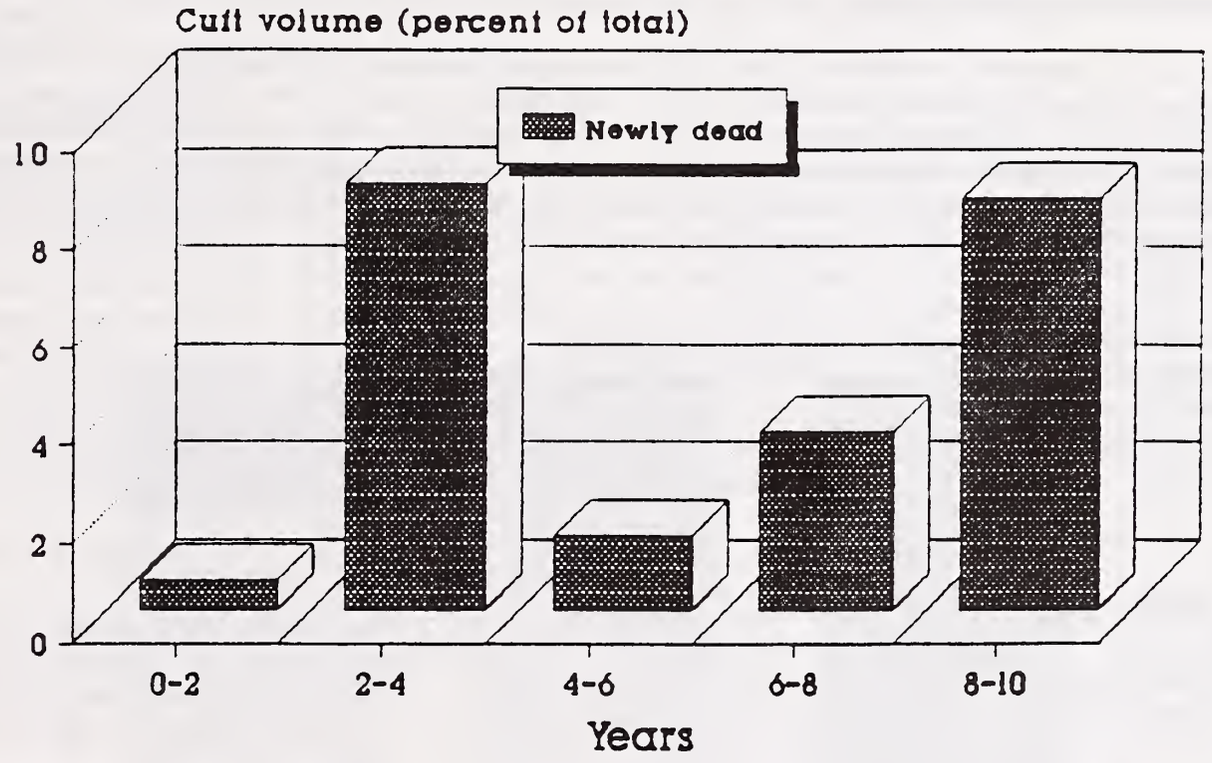


Figure 3.--Annual mortality rates due to Armillaria root disease in the Hellroaring stand, Flathead IR.

Armillaria/Phellinus Root Disease

- **Lonesome Creek Project.** Analysis was completed on 15 years of data from permanent plots in 100-year-old, root-diseased stands on the Lonesome Creek Watershed, Fernan RD, Idaho Panhandle NF (IPNFs). The analysis indicates that Douglas-fir was killed by root disease at a somewhat higher rate than grand fir. Stand volume in Douglas-fir was greatly reduced over the 15-year period; grand fir volume increased slightly. Commercial thinning increased the rate of Douglas-fir mortality and slightly decreased that of grand fir. This information should be viewed as preliminary since it came from only six stands in one location where both Phellinus and Armillaria root diseases were present. Nevertheless, Douglas-fir stands might be considered higher risk than those comprised mainly of grand fir in areas where both pathogens are present.

- **Buckskin and Freezeout Project.** Young stands of Douglas-fir and grand fir on the north end of Fernan RD, IPNFs, appeared to be relatively unaffected by root disease. These stands, in a 40- to 80-year age class, were fire regenerated. They may have had fairly large components of western white pine early in their development, but white pine blister rust was firmly established in the area by then, and the young white pines would have been very vulnerable to the disease. Whatever the reason, the stands are now dominated by Douglas-fir and grand fir. They appear outwardly healthy--so we wanted to monitor the stands in the hope of discovering why root disease impact is so different there from the south end where the 80- to 120-year-old stands have extensive root disease.

Three years after establishing permanent plots randomly over the Buckskin and Freezeout compartments we have discovered that the greatest difference in root disease impact (caused mostly by *Armillaria* and *Phellinus*) is probably due to the younger age class of the stands. Disease severities were lower compared with older stands to the south, but the frequency of severely affected plots indicates that they may be on the same track as the older stands (Figure 4). This paints a bleak future for these young stands but helps us plan for better management.

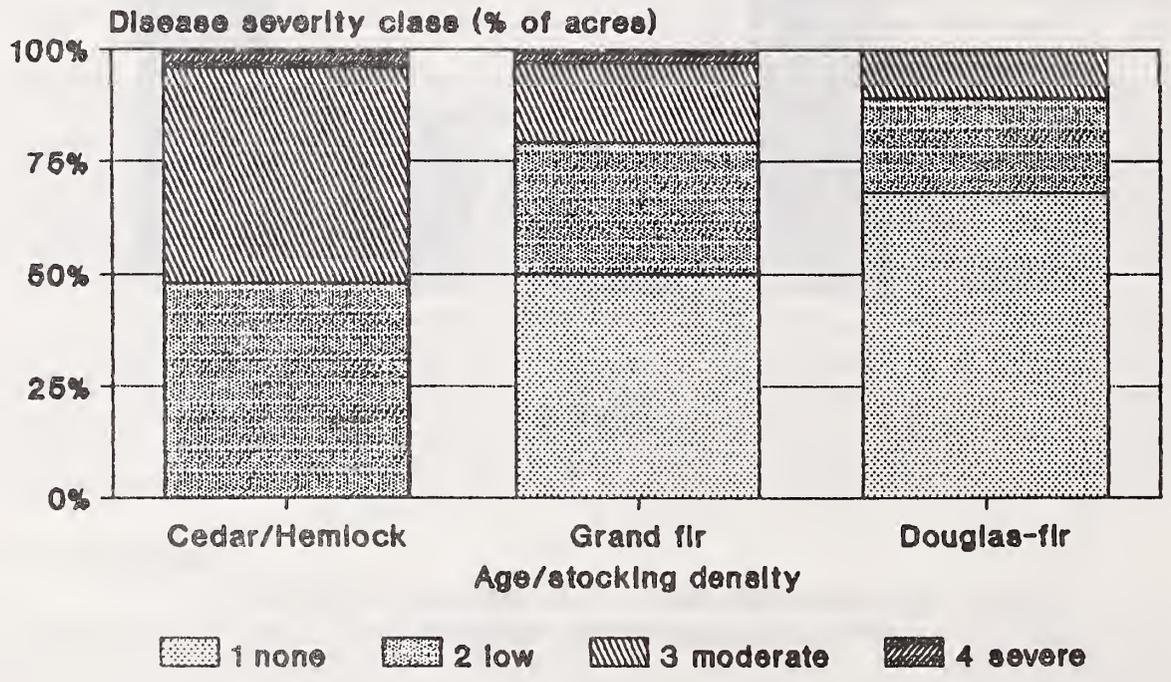


Figure 4.--Root disease severity by age and basal area in Buckskin permanent plots, Fernan RD, IPNFs.

Coeur D'Alene Basin Project

The IPNFs has undertaken a project to evaluate root disease on the Fernan and Wallace RDs. We are working with both districts and the Supervisor's Office to complete a two-part project to assess the current status of root diseases in the Coeur d'Alene basin and to develop management strategies for protection of the affected resources. Watershed and timber values will be a major focus. We will identify sites which require concerted rehabilitation efforts to return them to productivity. We hope to develop a schedule on which other sites can be expected to enter this rehabilitate-at-cost condition if intervention is not undertaken. And we will develop a rough estimate of the overall impact that root disease has had on the project area and a prediction of the expected trends over the next few years. This should give us a good idea of the impacts of root disease and what we need to do to be proactive in achieving our resource goals by restoring balance in the Coeur d'Alene Basin forests.

Root Disease Model

The model has had some major improvements in recent months and is running better than ever. It is also available for use locally on Data General (DG). The Prognosis model can now be used on DG, and the version with the pest models linked is now available as well. Contact Jim Brickell:R01A if you would like instructions to access a copy. Default values for attributing the root disease model need to be changed to produce reasonable results for this Region (remember it is a west-wide model) so contact Sue Hagle:R01A to obtain a file of parameters for your projections. Sue can help you with other questions about running the root disease model as well.

White Pine Blister Rust

Five years after pruning and excising cankers from a young white pine plantation on Palouse RD, Clearwater NF, permanent plots were re-evaluated. Treated trees were growing well and their disease status was stable. The "cure" rate for pruned trees, measured at 15 months after treatment, was 98 percent, and that for pruned and excised trees was 81 percent. The plots were revisited last fall (1990) and less than 1 percent of the treated trees had new lethal cankers (cankers within 2 feet of the stem). A small number of the excisions that had been judged successful at 15 months after treatment were found to be unsuccessful when re-examined after 5 years. Therefore, the success rate for excisions was 78 percent instead of 81 percent. This is the first project to establish permanent plots to evaluate treatment success. Hundreds of acres are treated by pruning and excising each year in this Region and additional permanent plots have been established in some of these stands to continue our evaluation of the efficacy of these treatments.

Dwarf Mistletoes

Work was begun by the Forest Pest Management Methods Application Group in Fort Collins, CO to revise the existing Prognosis-linked dwarf mistletoe model. Model revisions include modification of the spread and intensification equations and the addition of mortality functions. The revised version of the model is currently being tested by FPM and should be available for operational use late in 1991.

Nursery/Tree Improvement Diseases

Evaluation of the fate of *Fusarium* spp. on outplanted container-grown Douglas-fir seedlings (in cooperation with the University of Idaho) has been completed and results are being summarized. *Fusarium* continued to exist for three growing seasons on the roots of outplanted seedlings. However, these fungi were mostly restricted to the old plug roots and did not readily colonize new, egressed roots during seedling growth. These fungi were not important causes of seedling mortality.

Evaluations of sodium metabisulfite and hot water to clean styroblock and plastic containers continues to develop effective treatments to clean and remove potential pathogens from containers that are reused to grow several crops of seedlings.

An evaluation of *Gliocladium virens* to control root diseases of container-grown Douglas-fir seedlings was completed during the 1990 growing season. Dramatic control effects were not evident although data are currently being analyzed.

Biological control of *Fusarium oxysporum* by *Trichoderma harzianum* is currently being evaluated on container-grown Douglas-fir seedlings. *Trichoderma* isolates developed for their biocontrol potential on agricultural crops are being tested to control the common conifer nursery pathogen *Fusarium oxysporum*.

Table 1.--Chronic Disease Problems in Montana.

MOST IMPORTANT DISEASES

Disease	Host	Remarks
Armillaria Root Disease	Douglas-Fir Grand Fir Other Conifers	Widely distributed, especially west of the Continental Divide. This is the most damaging root disease in western Montana. Infected trees are often attacked by bark beetles.
Laminated Root Rot	Douglas-Fir Grand Fir Other Conifers	Occurs throughout the range of grand fir in northwestern Montana. Is known to be particularly damaging on the Lolo and Kootenai National Forests. Infected Douglas-fir and grand fir are often attacked by bark beetles.
Dwarf Mistletoes	Lodgepole Pine Douglas-Fir Western Larch	Dwarf mistletoes are widespread throughout the state and one of the leading causes of forest growth loss. Dwarf mistletoe-caused growth losses are estimated at about 33 M ft.^{3}/year. Lodgepole pine mistletoe occurs throughout the range of lodgepole pine. Douglas-fir mistletoe is scattered throughout the range of Douglas-fir west of a north-south line roughly 25 miles east of Missoula. Western larch mistletoe occurs throughout the range of western larch in western Montana.
White Pine Blister Rust	Western White Pine Whitebark Pine	Precludes the management of wild western white pine on all but low hazard sites throughout the range of western white pine. Rust resistant white pine has been successfully established on the Lolo, Kootenai, and Flathead National Forests. Whitebark pine damage varies from minor to severe. Severe damage to whitebark pine is of concern in the Glacier National Park ecosystem because the species is an important source of food for grizzly bears.
Indian Paint Fungus	Grand Fir Western Hemlock	Occurs throughout the range of hosts. This fungus is the major cause of defect in mature true fir and hemlock in western Montana.

Table 1.--Chronic Disease Problems in Montana (cont.)

DISEASES OF MINOR AND/OR LOCAL IMPORTANCE

Stem and Branch Diseases

Aspen Canker and Trunk Rot	Aspen	Are common in most aspen stands in Montana, particularly east of the Continental Divide.
Atropellis Canker	Lodgepole Pine	Found in pockets in pole-sized stands causing defect, topkill, and some mortality. Localized heavy infections are known to occur in western Montana.
Comandra Rust	Lodgepole Pine	Causes growth loss, deformity, and mortality. Can be locally important in lodgepole and ponderosa pine stands. Especially severe in lodgepole in south-central Montana.
Cytospora Canker	Subalpine Fir Douglas-Fir	Occurs throughout the range of hosts. Causes branch flagging in large trees and dead tops and mortality in seedlings and saplings. Large trees may be predisposed to bark beetle attack or killed directly following drought stress.
Diplodia Blight	Ponderosa Pine	Causes stunting and mortality of new shoots. Severe infections may lead to death of the tree in association with bark beetle attack. Diplodia is scattered throughout Montana, and locally severe at several locations.
Pini Rot	Western Larch Pines Douglas-Fir True Firs Spruce	Serious decay problem in mature conifers. May also occur at high levels in younger trees. Most important hosts are western larch and ponderosa pine.
Stalactiform Rust	Lodgepole Pine	Causes growth loss, topkill and mortality. Can be locally severe, especially in the Gallatin National Forest and some stands in the Beaverhead National Forest.
Western Gall Rust	Lodgepole Pine Ponderosa Pine	Causes stem and branch galls and mortality in small trees. Occurs throughout range of hosts. Infection levels are highly variable.

Table 1.--Chronic Disease Problems in Montana (cont.)

Root Diseases

Annosus Root Disease	Ponderosa Pine Subalpine Fir Other Conifers	Common in ponderosa pine stands west of the Continental Divide; especially severe on the Flathead Indian Reservation.
Black Stain Root Disease	Douglas-Fir Lodgepole Pine Ponderosa Pine	Has been confirmed in relatively few locations in the state, all of which are west of the Continental Divide.
Brown Cubical Root and Butt Rot	Douglas-Fir Other Conifers	Occurs throughout the range of hosts. Causes extensive root and butt rot, especially damaging in stands more than 80 years old.

Foliage Diseases

Elytroderma Needle Cast	Ponderosa Pine	Fungus infects the needles, twigs, and branches and causes broooming. Usually causes little damage, but severe, chronic infections can cause deformation and occasional death of small trees. Known to be locally severe in the Bitterroot Valley and around Flathead Lake.
Larch Needle Blight and Needle Cast	Western Larch	Occur throughout the range of the host. Needles are killed and growth loss can result from severe infections in successive years.
Rhabdocline Needle Cast and Swiss Needle Cast	Douglas-Fir	Occur throughout the range of host, and are quite common in northwestern Montana. Infected needles are killed and shed. Can cause economic damage in Christmas trees. Important in young plantations, including tree improvement areas.

NURSERY DISEASES

Cylindrocarpon Root Disease	Conifer Seedlings White Pine Douglas-fir	This fungus is capable of rapidly decaying roots, particularly of container stock. Severely infected trees may not display disease symptoms, but are discovered when seedlings are pulled from containers. The fungus is introduced on infested seed or in contaminated containers.
Diplodia Blight	Ponderosa Pine Lodgepole Pine	Most commonly a problem on bareroot ponderosa pine, but can also occur on lodgepole pine.

Table 1.--Chronic Disease Problems in Montana (cont.)

Fusarium Root Disease	Most Damaging on Douglas-fir Western Larch White Pine Engelmann Spruce	Root disease and damping-off caused by this fungus are two of the most important nursery diseases in Montana. This disease is damaging in both bareroot and container. operations. The fungi are common inhabitants of nursery soil and are introduced on infected seed and contaminated containers.
Grey Mold	Container-Grown Western Larch Engelmann Spruce	Occurs at some level during most years at many nurseries in Montana. Cultural and non-chemical strategies have been developed to reduce damage. Some fungicides are still necessary at certain times, and pathogen populations should be monitored for pesticide resistance.
Phoma Blight	Pines	Occurs on both bareroot and container-grown seedlings, and commonly can be found at low levels in most nurseries. The fungus is a common soil inhabitant and can be deposited on seedling foliage during rain or irrigation. Causes top dieback.
Pythium Root Disease	Most Conifers	Common soil-borne pathogens, especially damaging in poorly-drained soils where seedlings are stressed. Controlled by soil fumigation, but the fungus often rapidly reinvades the soil.
Sirococcus Shoot Blight	Pines Engelmann Spruce	Occurs at low levels on bareroot pine and container-grown spruce at nurseries in western Montana. Outbreaks have occurred at several nurseries in the past.

INSECTS

Bark Beetles

Mountain Pine Beetle

Mountain pine beetle (MPB) remained the most important insect pest of coniferous forests in the State, despite a continued decline in populations which began in 1982 (Fig. 5). In 1981, more than 2 million acres of all host species and all ownerships were infested Statewide. In 1990, that figure declined to slightly fewer than 200,000 acres (Tables 2 & 3).

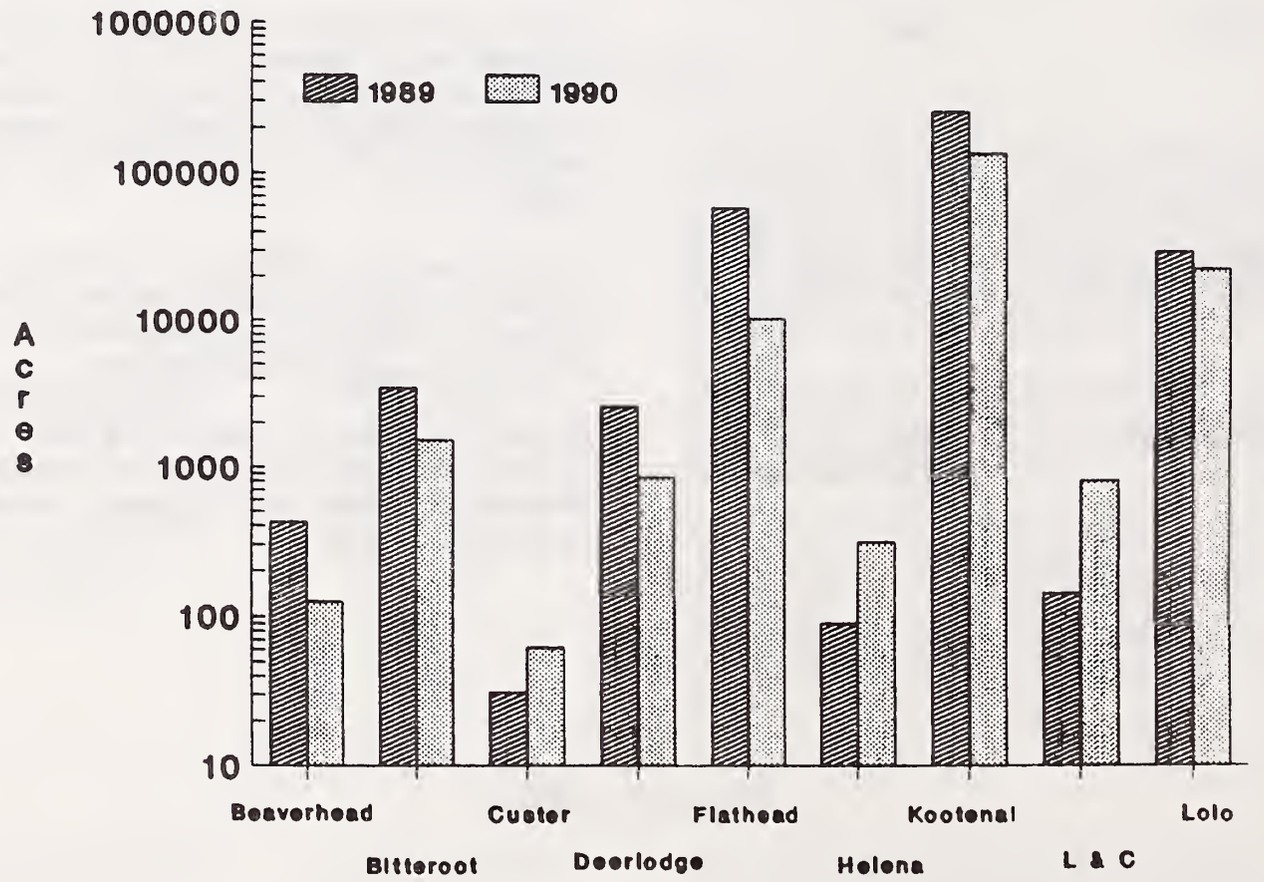


Figure 5.--Mountain pine beetle-infested acres on National Forest Service lands in Montana--1989-1990, based on aerial surveys.

Table 2.--Mountain pine beetle-infested acres on Federal lands in Montana and Yellowstone National Park (NP), 1989 and 1990, based on aerial surveys.

	1989				1990			
Area	LPP1/	PP	WBP	WWP	LPP	PP	WBP	WWP
Beaverhead NF	417	--	8	--	124	--	2	--
Bitterroot NF	44	3,397	--	--	14	1,505	--	--
Custer NF	13	18	--	--	--	44	18	--
Deerlodge NF	2,472	56	63	--	852	--	2	--
Flathead NF	57,375	19	799	254	8,157	14	109	2,124
Gallatin NF	89	--	--	--	--	--	--	--
Helena NF	5	8	78	--	279	34	2	--
Kootenai NF	248,033	10,636	327	484	132,858	1,770	105	1,392
L&C NF	46	98	--	--	8	810	--	--
Lolo NF	26,698	2,607	634	2	21,590	1,014	--	43
TOTAL NF	335,192	16,839	1,909	740	163,882	5,191	238	3,559
Glacier NP	1,085	--	--	52	--	--	--	--
Yellowstone NP	--	--	--	--	--	--	--	--
TOTAL NP	1,085	--	--	52	--	--	--	--
Blackfeet IR	--	--	--	--	--	--	--	--
Crow IR	--	1,228	--	--	--	174	--	--
Flathead IR	905	553	--	--	1,089	332	2	--
Ft. Belknap IR	--	1	--	--	--	--	--	--
N. Cheyenne IR	--	--	--	--	--	--	--	--
Rocky Boy's IR	4	1	--	--	4	6	--	--
TOTAL IR	909	1,783	--	--	1,093	512	2	--
TOTAL BLM	10	96	3	1	--	--	--	--
TOTAL FEDERAL	337,196	18,718	1,912	793	164,975	5,703	240	3,559

1/ LPP = Lodgepole Pine PP = Ponderosa Pine WBP = Whitebark Pine WWP = Western White Pine

- Kootenai Reporting Area. Serious outbreaks continued to occur in lodgepole pine stands on the Kootenai NF. Approximately 140,000 acres were infested on the Kootenai NF in 1990, compared to 265,000 acres in 1989. Mountain pine beetle populations continued to build in isolated stands on the Rexford RD, on both the east and west sides of Lake Koocanusa.

Scattered ponderosa pine mortality on 2,200 acres also occurred in the Kootenai reporting area. This is a reduction from 12,500 acres infested the previous year. Just over 1,400 acres of western white pine and 100 acres of high-elevation whitebark pine mortality due to MPB were also observed.

Areas of mountain pine beetle infestations in Montana and Yellowstone National Park (all host species), 1990.

Table 3.--Mountain Pine Beetle-Infested Acres on State and Private Lands,1989-1990, based on aerial surveys.

	1989				1990			
Area	LPP 1/	PP	WBP	WWP	LPP	PP	WBP	WWP
Beaverhead	152	1	2	--	11	--	--	--
Bitterroot	2	8,849	--	--	--	3,092	--	--
Custer	--	1	--	--	--	2	--	--
Deerlodge	35	4	--	--	152	--	--	--
Flathead	4,429	42	--	60	1,033	62	2	129
Gallatin	80	--	1	--	---	--	--	--
Garnets	1	551	--	--	10	723	--	--
Helena	41	165	--	--	364	112	--	--
Kootenai	17,608	1,860	--	7	8,981	439	--	22
Lewis & Clark	6	722	--	--	23	78	--	--
Lolo	5,356	1,237	--	--	2,561	1,185	--	--
Stillwater SF	18,137	1	--	5	4,415	--	--	172
Swan River SF	--	--	--	2	8	2	--	50
Thompson River SF	3,181	314	--	--	1,004	115	--	--
TOTAL	49,028	13,747	3	74	18,562	5,810	2	373

1/ LPP = Lodgepole Pine PP = Ponderosa Pine WBP = Whitebark Pine WWP = Western White Pine

- **Flathead Reporting Area.** Only a few years ago, the Flathead NF was one of the more seriously infested areas in the State. In 1990, there was a significant decline in acres of recently killed lodgepole pines. Only 9,000 acres were infested, compared to more than 62,000 acres in 1989. A few stands on the Swan and Hungry Horse RDs showed high numbers of new attacks in 1990. However, because of a decline of potential hosts, it is anticipated that populations will continue to decline in these and other areas within the Flathead NF.

Scattered stands of western white pine on the Hungry Horse and Glacier View RDs of the Flathead NF showed an increase in beetle-killed trees in 1990. A substantial portion of this mortality occurred in trees weakened by winter injury in 1989. Slightly more than 2,200 acres were affected.

Only small amounts of ponderosa and whitebark pine mortality associated with MPB attacks were observed throughout the Flathead reporting area.

- **Lolo Reporting Area.** The Lolo reporting area contained the second highest number of beetle-killed trees in Montana in 1990. Although this was a reduction from 1989, it was not as large a drop as was reported in other areas. Slightly more than 24,100 acres of lodgepole pine had some level of mortality, compared to 32,100 in 1989. Mountain pine beetle populations were still very active and increasing in stands within the Little Thompson River drainage on the Plains\Thompson Falls RD.

Recent MPB mortality was observed on 2,000 acres of ponderosa pine throughout the Lolo reporting area, largely on private lands. This was approximately half the infested acres recorded in 1989.

- **Other Areas.** Significant beetle-caused mortality was observed on the Deerlodge NF, Flathead Indian Reservation, and Stillwater and Thompson River State Forests. However, the total number of infested acres was less than that recorded in 1989.

Mountain pine beetle will likely continue to decline throughout the State, largely because of the reduction in susceptible host stands as a result of forest management practices and beetle depredation. Although locally severe MPB outbreaks may continue in areas where susceptible stands remain, infestations are not expected to reach the expansive levels seen previously.

Douglas-Fir Beetle

There was a moderate increase in the number of acres of Douglas-fir killed by the Douglas-fir beetle (DFB) in 1990 (Figure 6). In 1989, approximately 6,300 acres contained beetle-killed trees (Table 4). In 1990, the area increased to slightly more than 9,000 acres. However, ground surveys indicated that the population was decreasing Statewide. Apparent increases in 1990 may have been partially due to the difficulty in distinguishing year of kill from aerial surveys, rather than actual population increases.

Most infested acres were recorded on the Beaverhead (3,000 acres), Bitterroot (2,700 acres), Lolo (1,500 acres) and Kootenai (1,200 acres) reporting areas.

Nearly normal precipitation in 1989 and 1990 and increased salvage logging of infested stands resulted in an overall reduction in acres infested. We expect this trend to continue over the next few years if weather conditions remain normal.

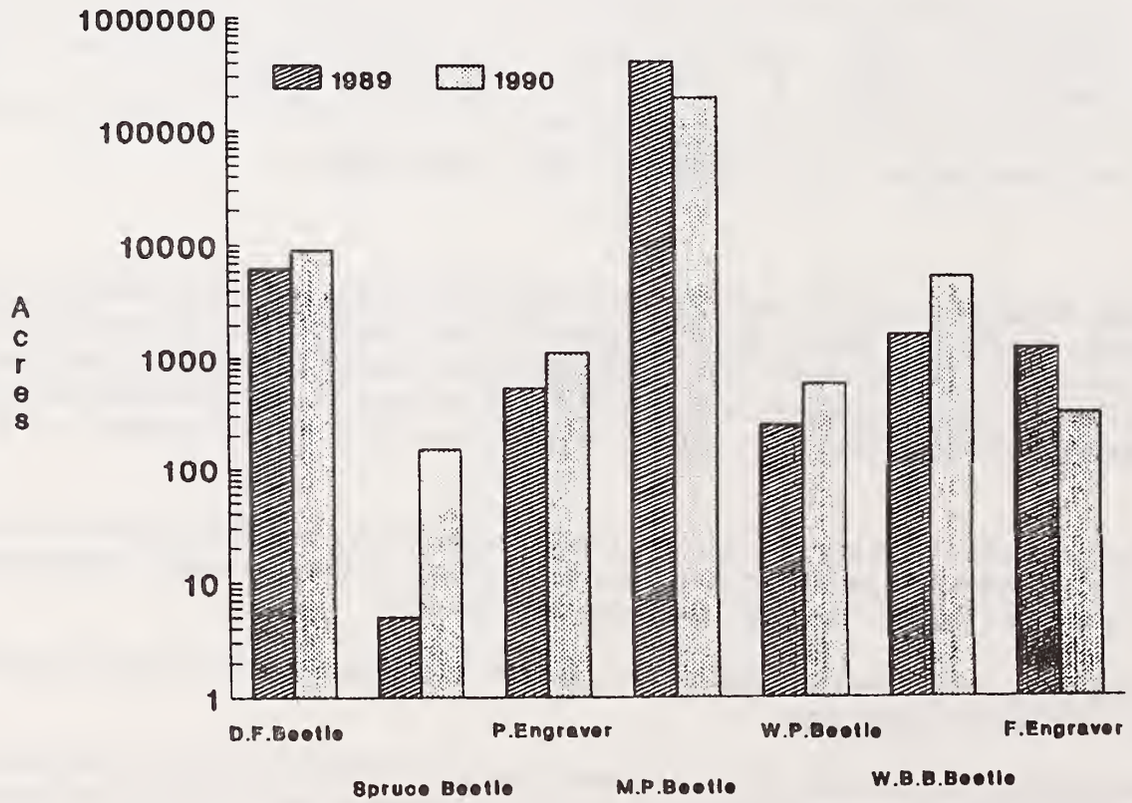


Figure 6.--Bark beetle-infested acres of all ownerships, 1989-1990, based on aerial surveys.

Table 4.--Bark Beetle-Infested Acres (Other than Mountain Pine Beetle) In Montana and Yellowstone National Park--1990.

	Douglas-Fir Beetle		Engelmann Spruce Beetle		Pine Engraver		Western Pine Beetle		Western Balsam Bark beetle		Fir Engraver	
Reporting Area	Fed.	S&PF	Fed.	S&PF	Fed.	S&PF	Fed.	S&PF	Fed.	S&PF	Fed.	S&PF
Beaverhead NF	2,703	263	--	--	--	--	--	8	4,933	217	2	--
Bitterroot NF	2,711	58	6	--	--	--	57	29	18	--	--	--
Custer NF	2	--	--	--	--	--	--	--	31	--	--	--
Deerlodge NF	6	--	--	--	--	--	--	4	33	--	--	--
Flathead NF	170	26	137	--	--	--	--	4	52	4	--	4
Gallatin NF	--	--	--	--	--	--	--	--	--	--	--	--
Garnets	--	45	--	--	--	--	--	84	--	8	--	--
Helena NF	2	8	--	2	224	350	16	38	10	--	--	--
Kootenai NF	1,178	62	--	--	--	--	62	18	18	--	8	--
Lewis & Clark NF	2	--	2	2	43	--	--	--	4	--	--	--
Lolo NF	1,313	233	--	--	--	46	126	34	18	4	114	43
Glacier NP	--	--	--	--	--	--	--	--	--	--	--	--
Yellowstone NP	--	--	--	--	--	--	--	--	--	--	--	--
Blackfeet IR	--	--	--	--	--	--	--	--	--	--	--	--
Crow IR	--	--	--	--	--	--	--	--	--	--	--	--
Flathead IR	115	--	--	--	101	--	106	--	32	--	89	--
Ft. Belknap IR	--	--	--	--	--	--	--	--	--	--	--	--
N. Cheyenne IR	--	--	--	--	377	--	--	--	--	--	--	--
Rocky Boy's IR	--	--	--	--	--	--	--	--	--	--	--	--
BLM	56	--	2	--	--	--	12	--	121	--	--	--
Stillwater SF	2	--	--	--	--	--	--	--	--	2	--	--
Swan River SF	--	127	--	--	--	--	--	--	--	2	--	74
Thompson River SF	--	8	--	--	--	--	--	12	--	--	--	74
TOTAL	8,258	830	147	4	745	396	379	231	5,270	235	213	121

Western Pine Beetle

Area infested by the western pine beetle (WPB) increased slightly in 1990. However, there was a decrease in the number of trees killed (Table 4). Throughout western Montana, 350 beetle-killed trees were recorded over 600 acres. The decline in WPB was most likely due to improved soil moisture conditions.

Western Balsam Bark Beetle

An increase in mortality of subalpine fir at high elevations due to western balsam bark beetle (WBBB) was recorded in 1990 (Table 4). Most of the mortality occurred in the Tobacco Root Mountains, Madison RD, Beaverhead NF. More than 5,500 acres of mortality were observed Statewide; fewer than 1 tree per acre was usually killed. Much of the mortality is the result of an interaction between bark beetles and root diseases.

Pine Engraver Beetle

Significant outbreaks of pine engraver beetle occurred on the Helena and Custer NFs and the Northern Cheyenne IR (Table 4). Prolonged drought and logging practices that provided continual brood sites contributed to an increase in mortality. As long as dry conditions persist and slash is not adequately treated, beetle populations are expected to remain high.

Other Bark Beetles

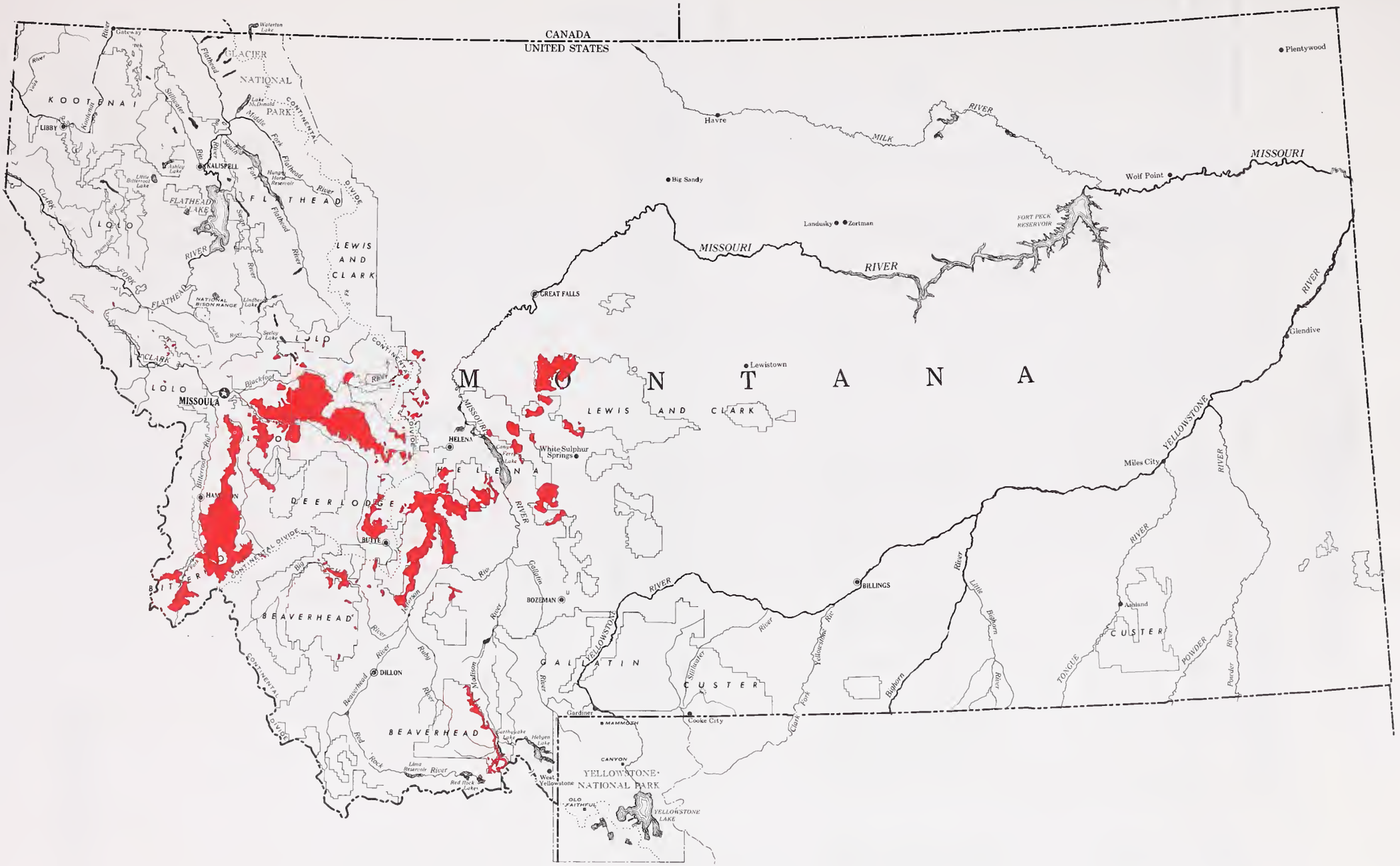
Spruce beetle and fir engraver were detected in scattered locations throughout the western half of the State at endemic levels (Figure 6). On the Hungry Horse RD, Flathead NF, 130 acres of spruce stands had minor amounts of spruce beetle-caused mortality. On the Lolo NF, Plains/Thompson Falls RD, 120 acres of grand fir were killed by fir engraver. Other areas had widely scattered, small patches of mortality totaling fewer than 50 acres for each beetle.

Defoliators

Western Spruce Budworm

Aerially visible defoliation by western spruce budworm on all ownerships in Montana totaled 1,482,417 acres in 1990, an increase from the 1,191,951 acres defoliated in 1989 (Table 5). Increases in defoliation acres occurred on the Bitterroot, Garnets, Helena, and Lewis and Clark reporting areas. The largest increase occurred on the Lewis and Clark reporting area where defoliation was 120,231 acres in 1990, compared to 10,783 acres in 1989. This represented an 11-fold increase. Defoliated acres more than tripled on the Bitterroot reporting area.

Reporting areas having less defoliation in 1990 were the Beaverhead, the Deerlodge, and the Lolo.



Western spruce budworm defoliation visible from the air in Montana and Yellowstone National Park, 1990.

Table 5.--Acres of Visible Western Spruce Budworm Defoliation on all Ownerships in Montana--1989 and 1990.

	All Ownerships		1990 Acres by Ownership			
Reporting Area	1989	1990	NFS	BLM	State	Private
Beaverhead NF	228,884	60,064	38,844	11,923	1,085	8,212
Bitterroot NF	122,842	377,769	273,343	--	23,136	81,290
Deerlodge NF	345,404	298,881	138,229	50,567	8,077	102,008
Flathead IR	91	80	--	--	--	80
Gallatin NF	--	*	*	*	*	*
Garnets	233,065	321,891	--	69,206	35,702	216,983
Helena NF	124,306	212,790	103,513	13,893	6,488	88,896
Lewis & Clark NF	10,783	120,231	76,357	4,290	2,415	37,169
Lolo NF	126,576	90,711	52,913	1,976	4,428	31,394
TOTAL	1,191,951	1,482,417	683,199	151,855	81,331	566,032

* Area not surveyed in 1990.

Douglas-fir Tussock Moth

Pheromone trap catches of adult male moths were monitored at 33 permanent plots in 1990; moths were caught at 20 of the sites. 427 moths were trapped in 1990 with populations concentrated in the Polson and Somers areas. While this trap catch is well below the peak of 1983, it does represent an increase from the 1989 catch (Figure 7). Trapping efforts will be increased in the next few years to monitor future moth population levels.

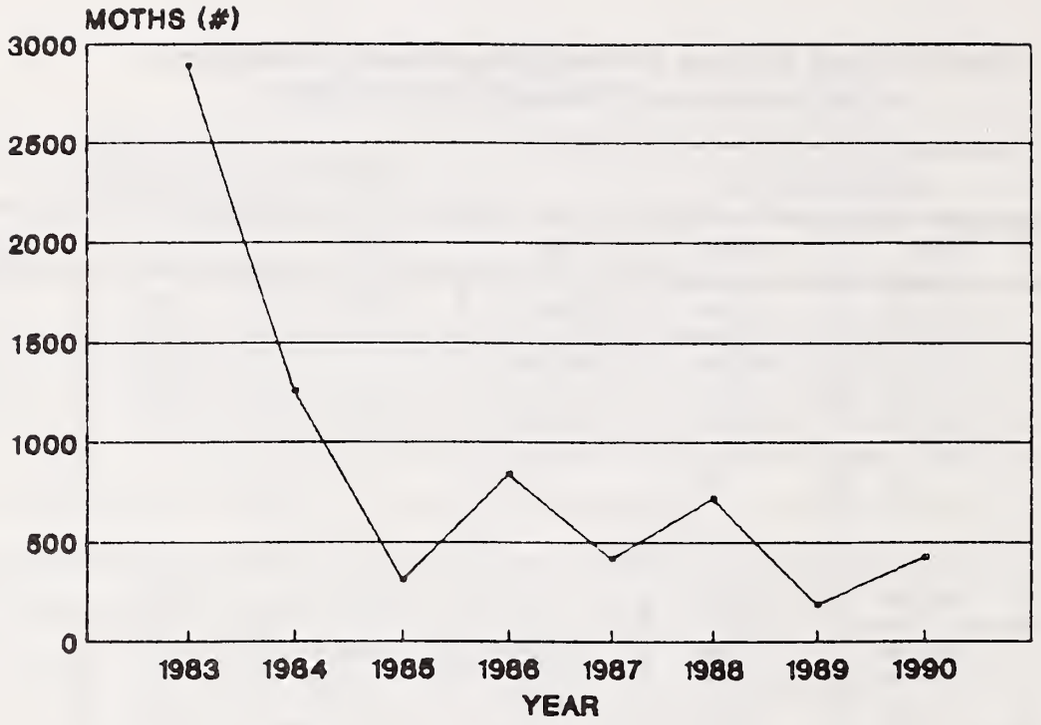


Figure 7.--Douglas-fir tussock moth trap catch in western Montana, 1983-1990.

Gypsy Moth

The Animal and Plant Health Inspection Service (APHIS) and cooperators (USDA Forest Service, Montana Department of State Lands) placed 1,447 gypsy moth detection traps in Montana in 1990. For the second year, only one moth was caught in the State in a trap located in Great Falls. One additional moth was trapped in nearby Yellowstone National Park at Madison Campground. Detection trapping efforts will continue in Montana in 1991. Delimitation trapping will also be done in Great Falls and Yellowstone National Park.

Pine Butterfly

Pine butterfly populations in the Lost Lake area southeast of Polson declined in 1990, and no visible defoliation occurred. High adult population levels were observed in Pablo in 1990, and examination of overwintering eggs indicated that populations in this area will again be high in 1991.

Western False Hemlock Looper

Approximately 50 blue spruce, which were part of an extensive windbreak planting on a ranch northwest of Polson, were severely defoliated by the looper in 1990. Similar damage also occurred on some of the same trees in 1989. If populations continue at high levels in 1991, suppression efforts will be initiated.

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COMMON AND SCIENTIFIC NAMES

	Diseases
Annosus root disease	*Heterobasidion annosum* (Fr.) Bref.
Armillaria root disease	*Armillaria ostoyae* (Romagn.) Herink
Atropellis canker	*Atropellis piniphila* (Weir) Lohm. and Cash
Black stain root disease	*Ceratocystis wageneri* Goheen and Cobb
Brown cubical butt rot	*Phaeolus schweinitzii* (Fr.) Pat.
Comandra rust	*Cronartium comandrae* Peck.
Cytospora canker	*Cytospora abietis* Sacc. and *C. kunzei* Sacc.
Damping-off	*Fusarium* sp., *Pythium* sp.
Diplodia blight	*Sphaeropsis sapinea* (Fr.) Dyko.
Douglas-fir needle cast	*Rhabdocline pseudotsugae* Syd. and *R. weirii* Parker and Reid
Dwarf mistletoes	*Arceuthobium* spp.
Elytroderma needle cast	*Elytroderma deformans* (Weir) Darker
Fusarium root disease	*Fusarium oxysporum* Schlect.
Grey mold	*Botrytis cinerea* Pers. ex Fr.
Larch needle blight	*Hypodermella laricis* Tub.
Larch needle cast	*Meria laricis* Vuill.
Indian paint fungus	*Echinodontium tinctorium* E. and E.
Laminated root rot	*Phellinus weirii* (Murr.) Gilb.
Pini rot	*Phellinus pini* (Thore:Fr.) Pilet.
Stalactiform rust	*Cronartium coleosporioides* Arth.
Western gall rust	*Endocronartium harknessii* (Moore) Hirat.
White pine blister rust	*Cronartium ribicola* Fisch.
	Insects
Douglas-fir beetle	*Dendroctonus pseudotsugae* Hopkins
Douglas-fir tussock moth	*Orygia pseudotsugata* (McDunnough)
Gypsy moth	*Lymantria dispar* (Linnaeus)
Mountain pine beetle	*Dendroctonus ponderosae* Hopkins
Pine engraver	*Ips pini* (Say)
Spruce beetle	*Dendroctonus rufipennis* (Kirby)
Western balsam bark beetle	*Dryocoetes confusus* Swaine
Western spruce budworm	*Choristoneura occidentalis* Freeman
Western pine beetle	*Dendroctonus brevicomis* LeConte
Fir engraver	*Scolytus ventralis* LeConte
Pine butterfly	*Neophasia menapia* (C. and R. Felder)

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